



# **Conservation Behavior by Residential Consumers During and After the 2000-2001 California Energy Crisis**

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# Research Questions

What was the nature of the behavioral response during and immediately after the Summer 2001 crisis?

What conservation actions were taken?

What energy impacts were observed?

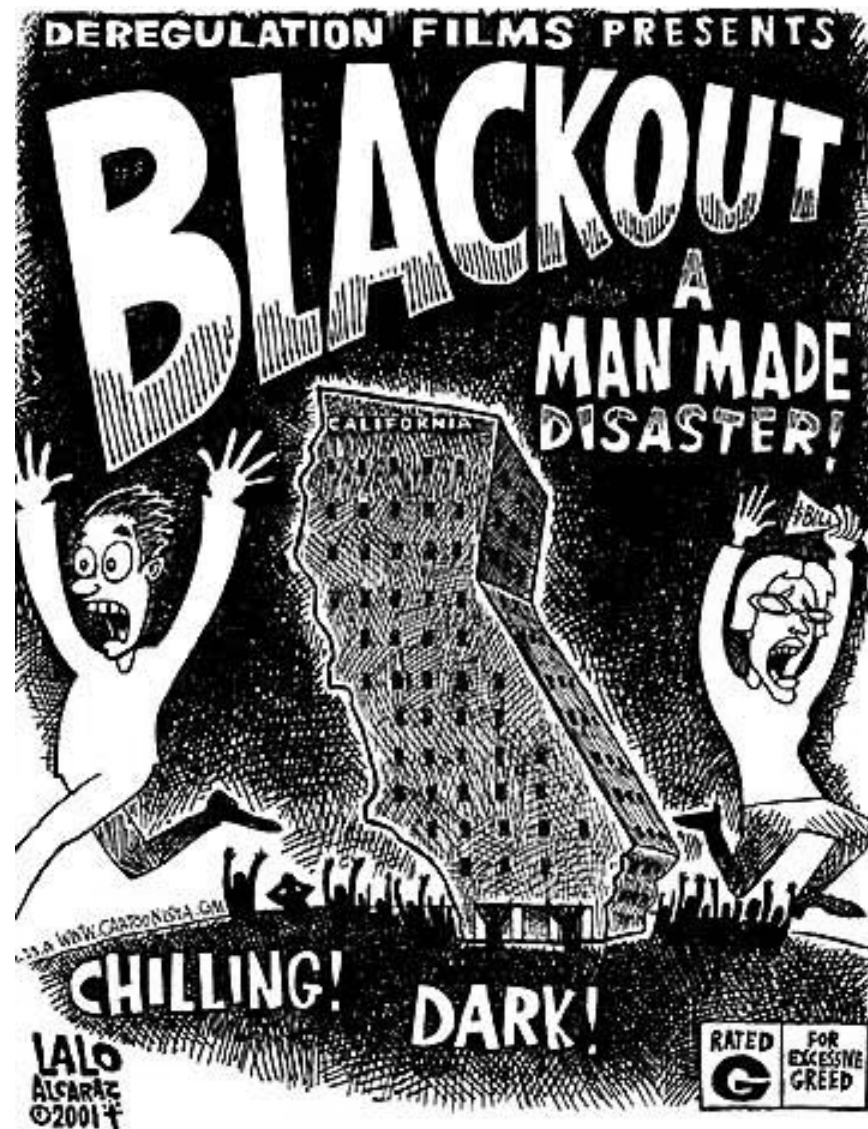
Where and by whom?

How did the response evolve after the crisis?



# Topic Outline

- Recall the events of 2000-2001 Energy Crisis
- Key Findings
  - Actions taken by Residential Consumers
  - Motivations for their Actions
  - Actions Continued after the Crisis
- Consumer Views of Energy Issues
- Lessons for Energy Efficiency and Demand Response Policies



# Timeline of the Crisis Experience



- *2000*: Trouble brews; “Energy Crisis” comes into definition; newspapers are on it
- *January 2001*: N. Cal rolling blackouts followed by 32 days of Stage 3 alerts, doom & gloom, supply vs. conservation, suspicions
- *February 2001*: *Flex Your Power* (simple behaviors)
- *May 2001*: Rolling blackouts
- *Summer 2001*: 20/20, waning interest, forward motion on building independent supply
- *September 2001*: Summer ends, no blackouts since May, apparent surplus, Enron etc., 9/11
- *December 2001*: Turn on your holiday lights



# Methodology

Residential telephone survey waves  
(1,666 interviews in 2001 & 864 in 2002)

Billing data matched to same households

Large sample billing/weather analysis  
(5k x 5 utils = 25,000 cases)

Media analysis



# Findings

- 1) Unexpected consumer demand elasticity added flexibility to the energy market.
- 2) Changes in consumption in 2001 compared to 2000 were not artifacts of weather differences.
- 3) Changes in behavior rather than efficiency improvements accounted for most of the 2001 reduction.

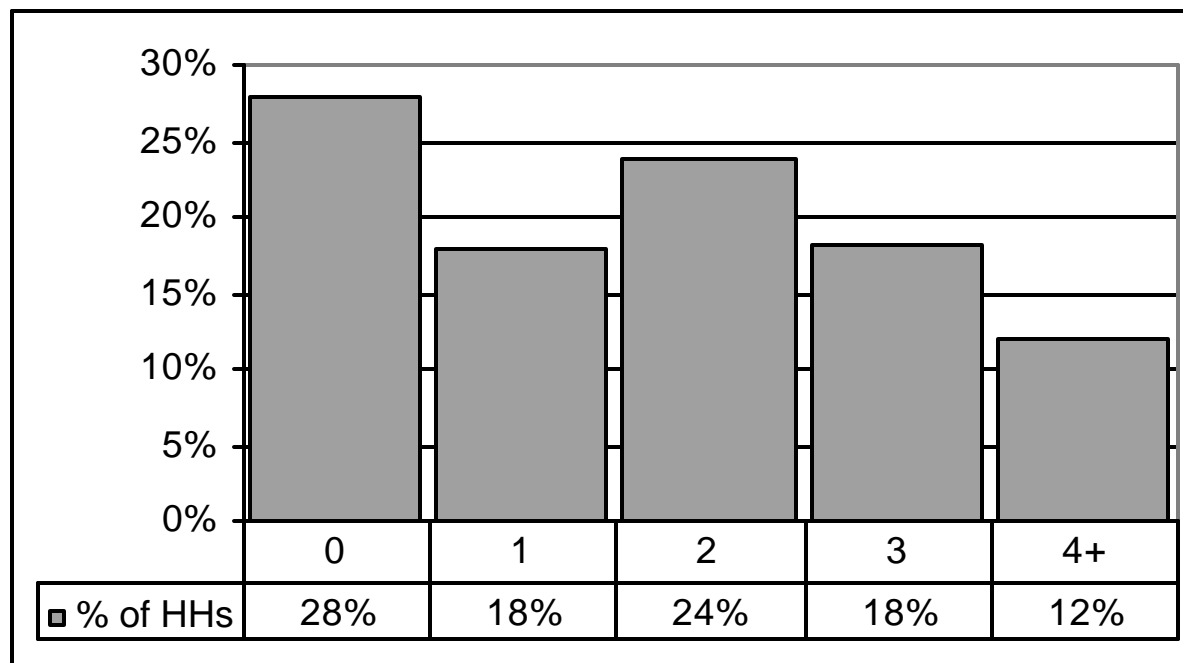


- 4) An important contributor to lower consumption was consumer willingness to turn off air conditioners.
- 5) Persistence of some behavioral changes long after the immediate crisis had passed.
- 6) Behavioral changes were often not induced by prices, but by civic concerns and altruistic motives.



# Unexpected Consumer Demand Elasticity Added Flexibility to the Energy Market

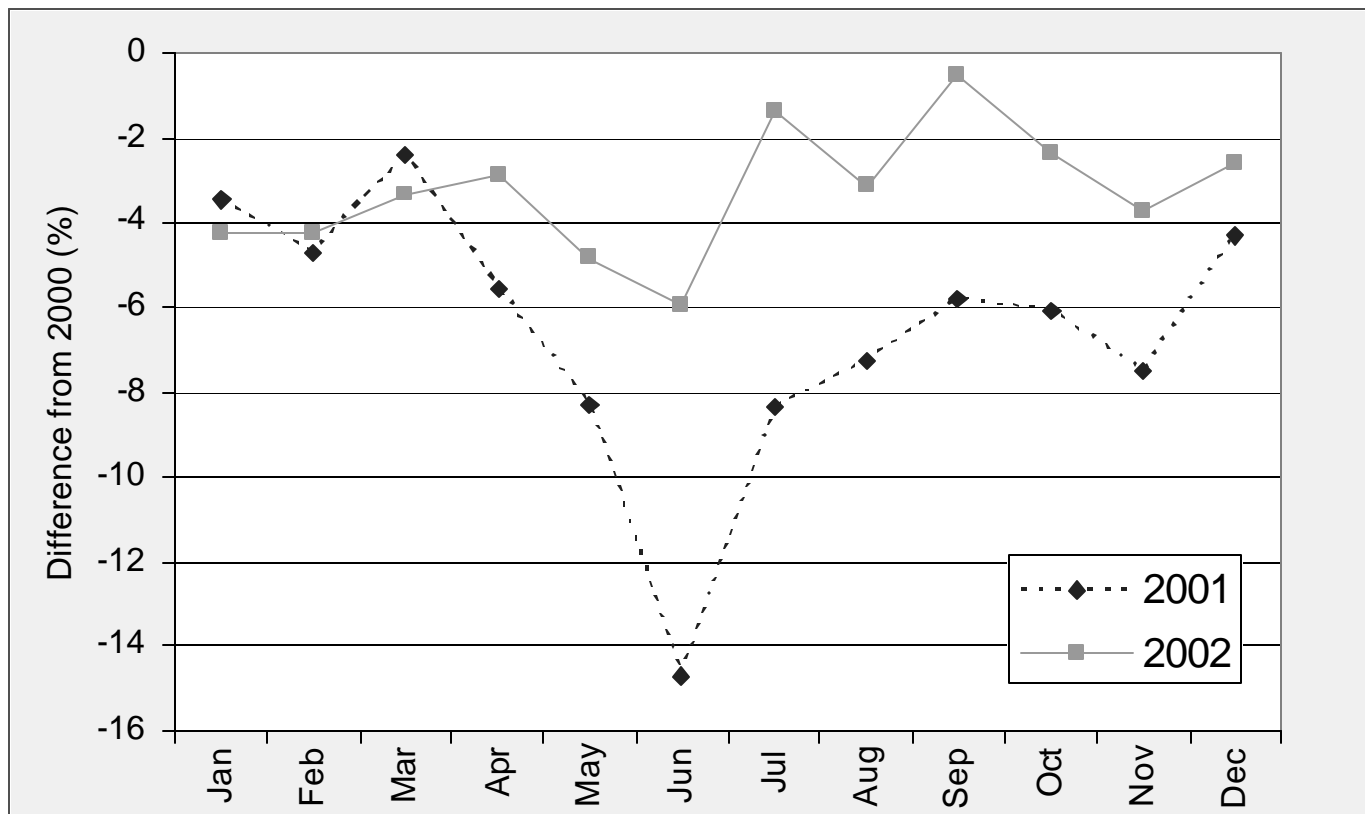
A high proportion (75%) of all households reported taking some conservation action.



mean = 2.4  
for conservers



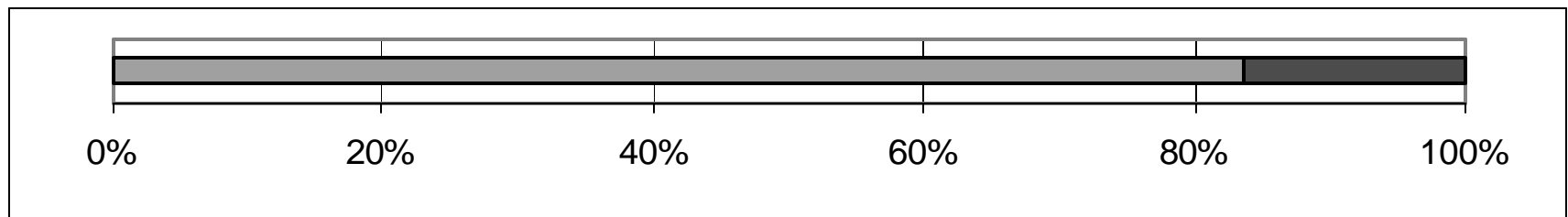
# Changes in Consumption not Driven by Weather or Economy





# Changes in Behavior Accounted for Most of the 2001 Crisis Response

- Hardware solutions were heavily promoted both during and after the 2001 crisis period but demand reductions were largely due to *changes in behavior*.
- 84% of all reported conservation actions were behavioral changes while 16% were either appliance / equipment purchases or building improvements:





# Willingness to Turn off the A/C Contributed to Lower Consumption

2001 survey results regarding A/C use:

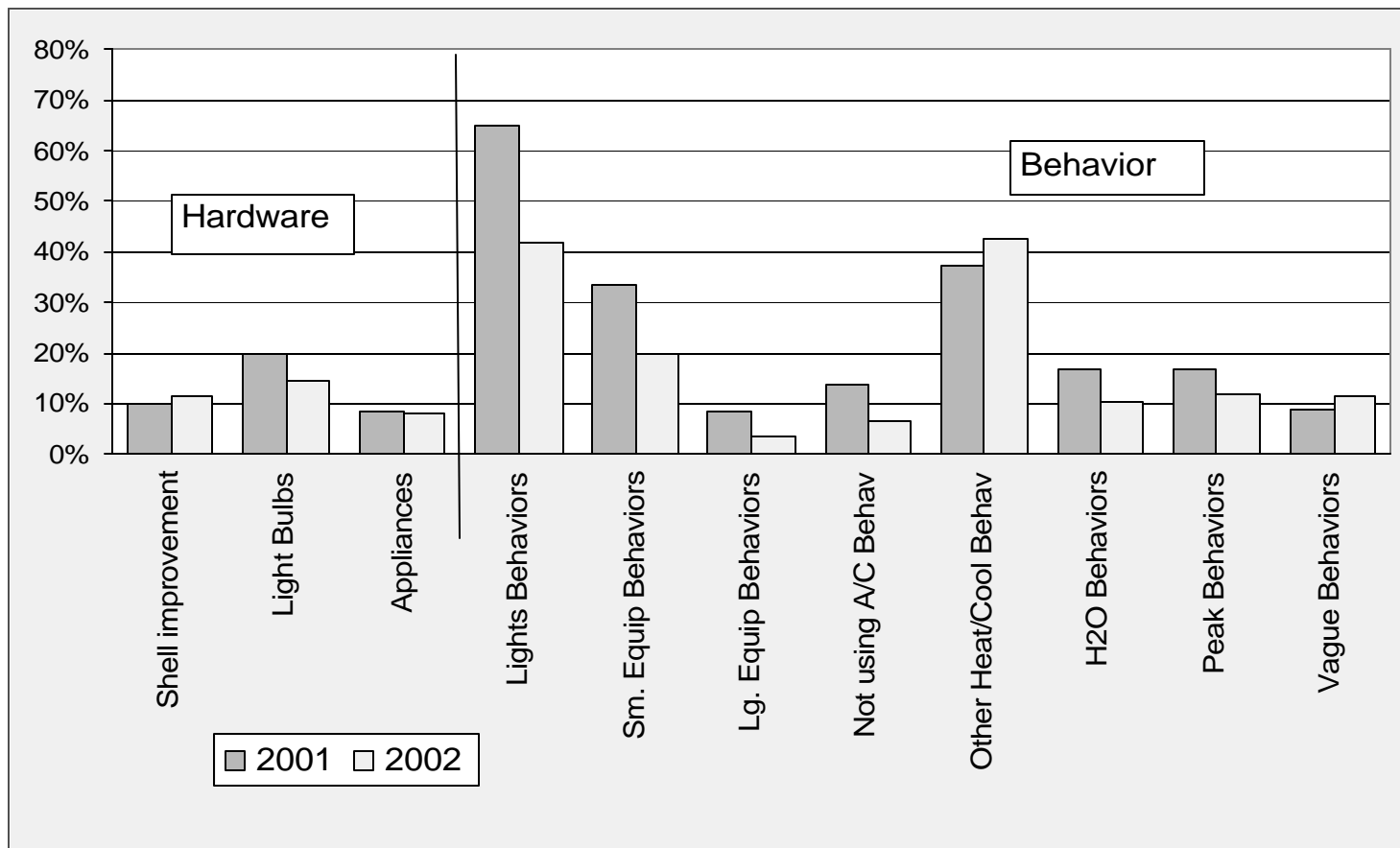
- 36% of Central A/C owners used little or no A/C
- 29% of Room A/C owners used little or no A/C

Cooling accounts for an est. 35.5% of Peak (MW) and 7.4% of annual residential consumption (*HELM data*)

- ✓ In terms of Emergency Response potential – A/C reduction can deliver large kWh savings.
- ✓ However, many other behaviors contribute to long-range conservation benefits ...



# Conservation Actions in 2001 and 2002

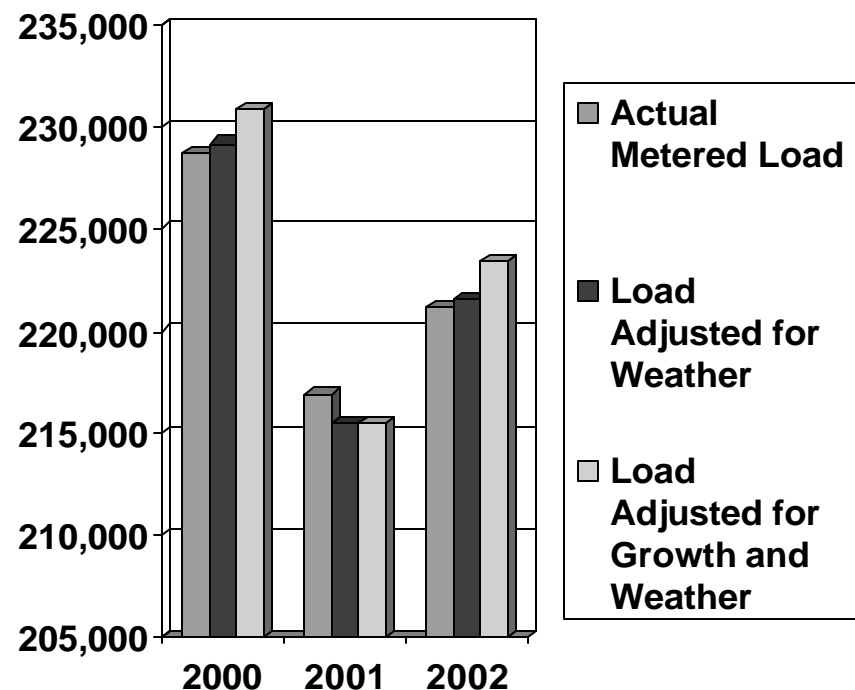




# Some Behavioral Changes Continued After Crisis Passed

“The results show that after adjusting for weather and economic growth almost fifty percent of the conservation observed in 2001 continued to persist in 2002. As shown in the table, adjusted annual consumption for the CAISO area was 3.7% higher than demand in 2001, but still 3.2% lower than 2000.”

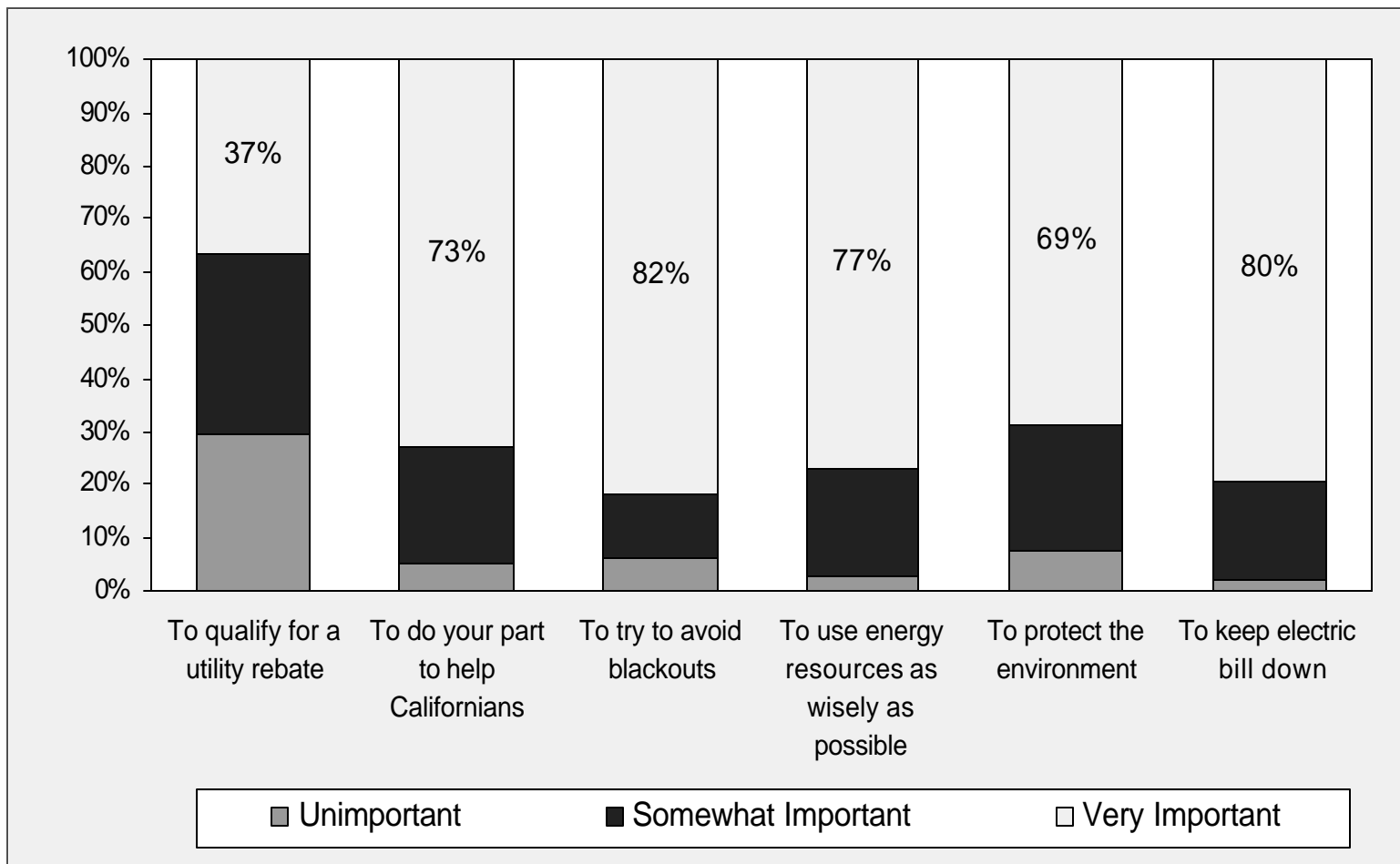
*(CEC Impact Report)*



**CEC Demand Analysis Office, April 2003 report,  
CAISO settlement-quality metered load data and  
revised employment data from the CA  
Employment Development Department**



# Changes were Motivated by Civic Concerns as much as Prices





# Influences & Knowledge Sources

- 44% news stories on TV
- 31% advertisements on TV
- 24% information from radio
- 21% information in utility bill
- 11% friends/neighbors
- 10% information from Internet
- 83% past experience or common sense



## Reasons Given in 2002 Survey for Less Conservation

“With crisis gone, no more need” 12%

“Just easy to slip back into old ways” 46%

“No need after summer” 34%

“Security reasons” 7%

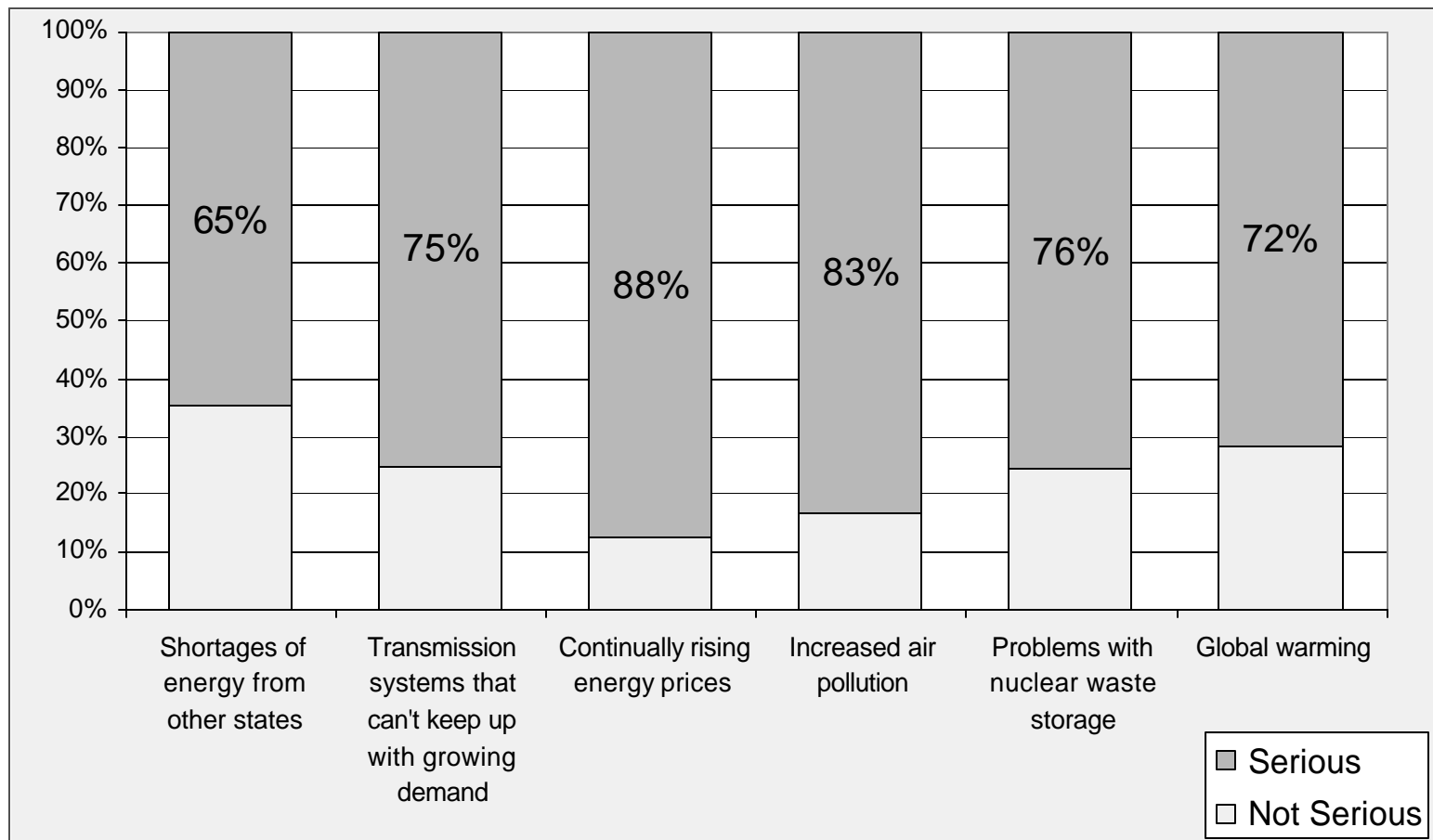
“Too difficult or inconvenient” 2%



# Emerging Consumer Views of Energy Issues and Energy Policies



# Seriousness of Future Energy Problems





# Conservation Policy Assessment from Consumer Viewpoint

“It makes sense to ask citizens every once in a while to reduce their energy use ... to avoid blackouts and keep costs down”

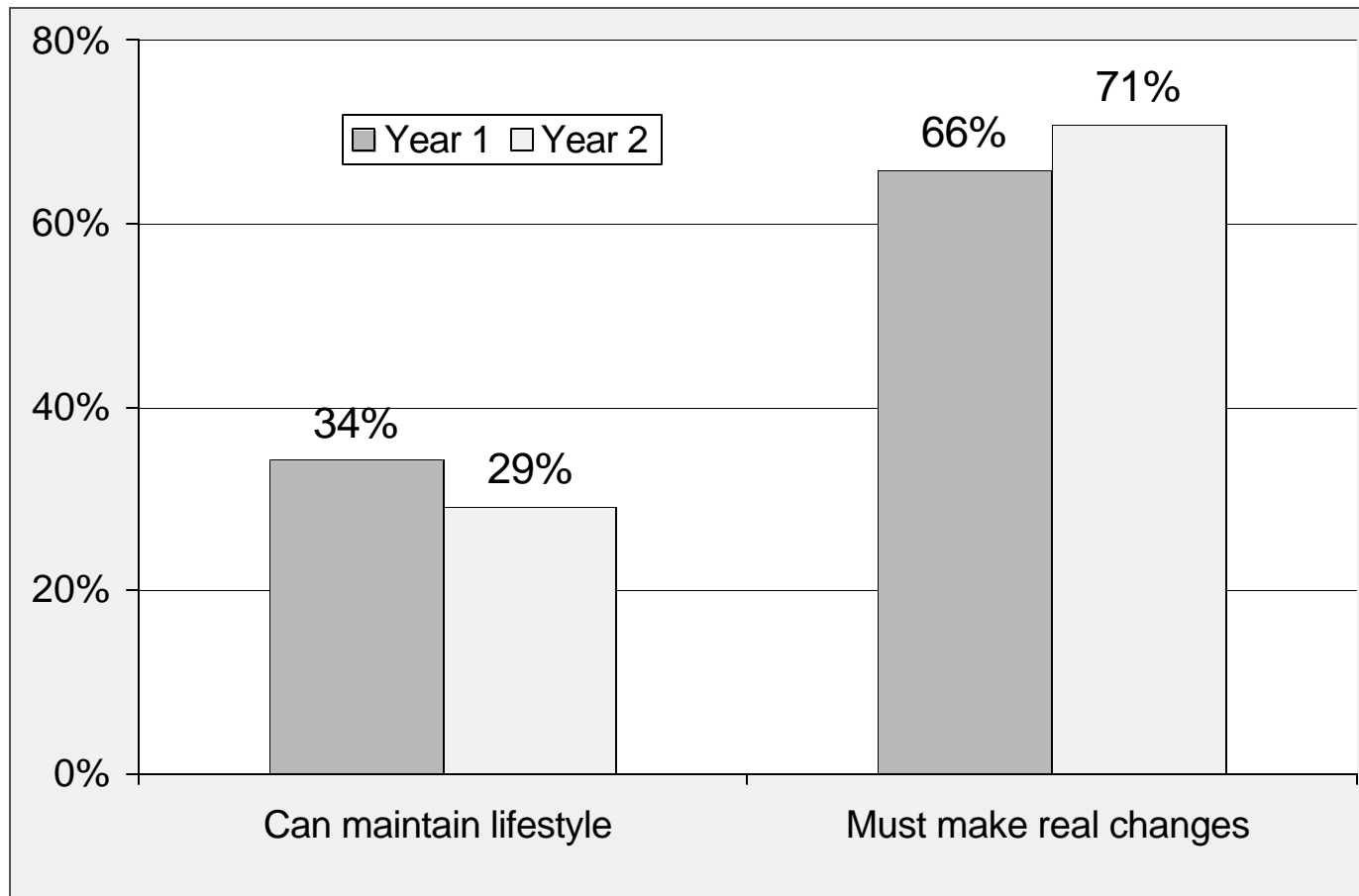
*agree* = 93%  
*disagree* = 7%

“It’s worth it to *pay more* ... in order to *never* be asked to conserve”

*agree* = 12%  
*disagree* = 88%



# Lifestyle Change Needed to Solve Energy Problem?

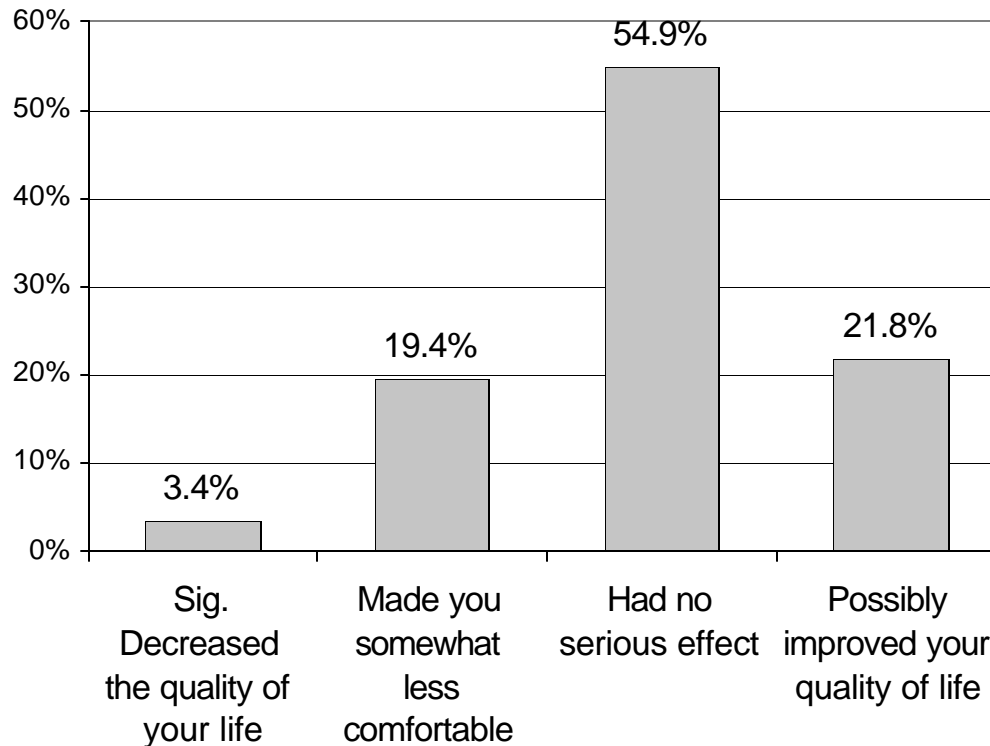




# Views on Quality of Life while Conserving

**In 2001**

**In 2002**



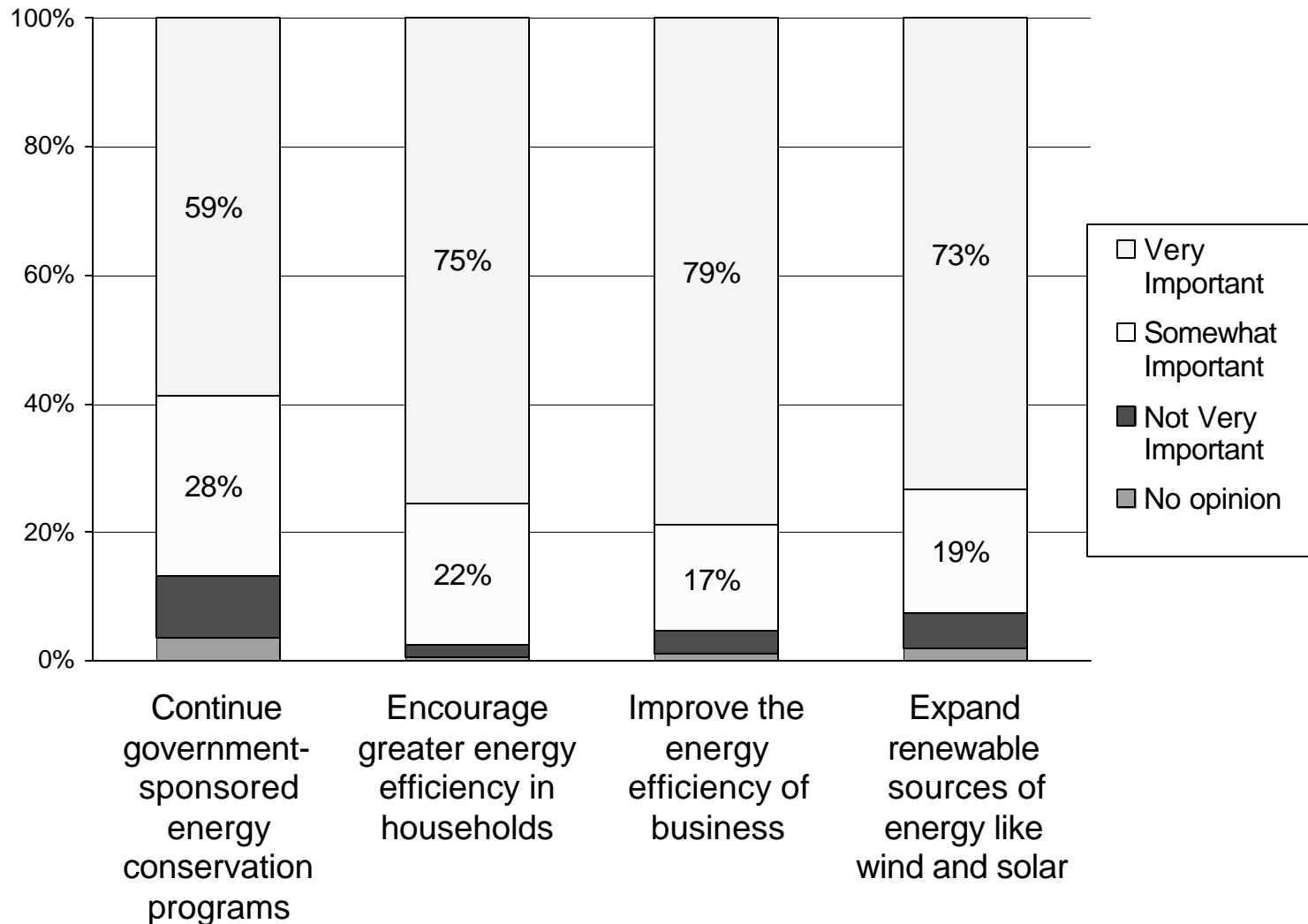
“My conservation  
efforts ... have  
involved real  
sacrifices”

agree = 40%

disagree = 60%



# Importance of EE & Renewables

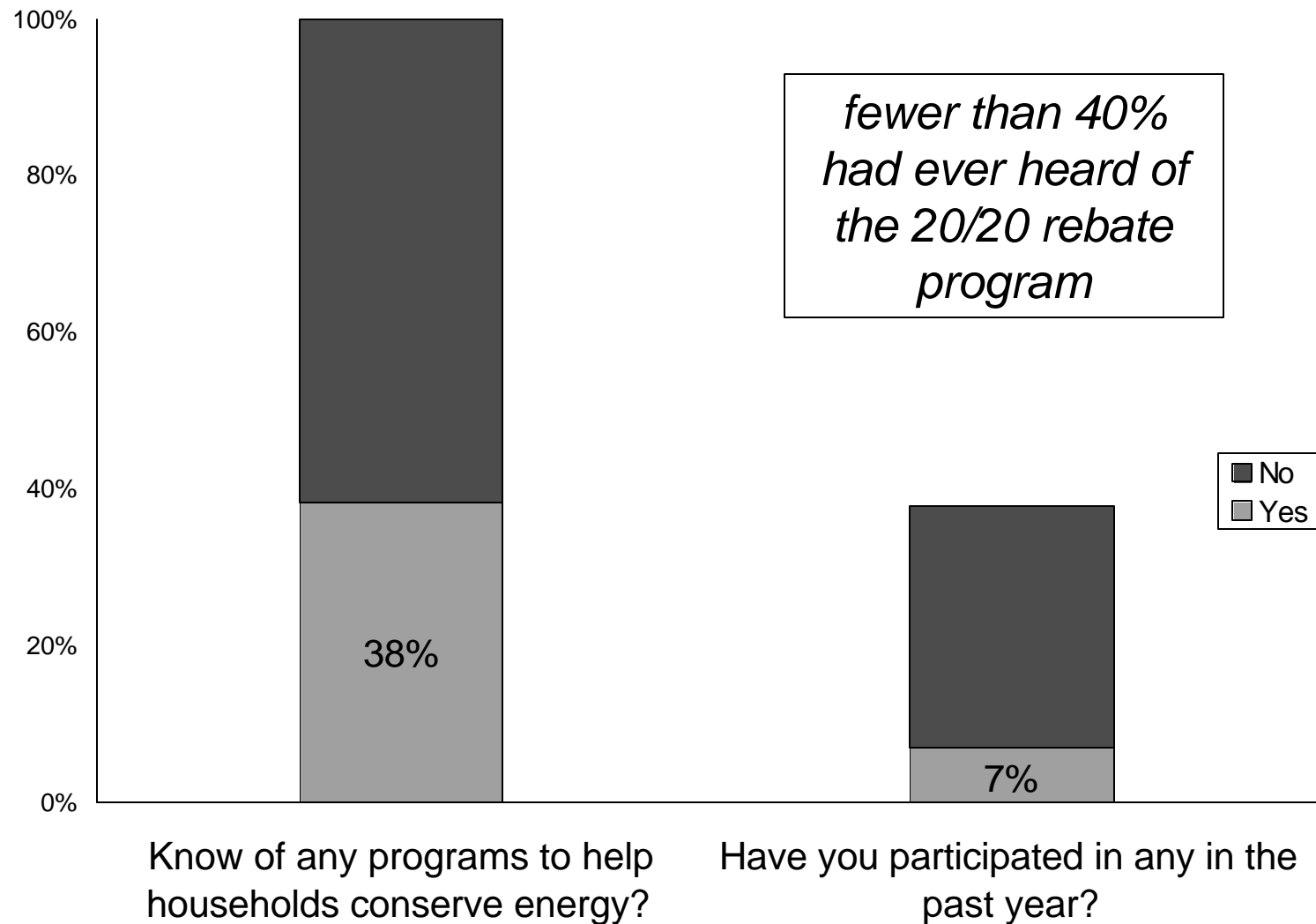




But the devil is in the details



# Overall Program Awareness





## Potentials for Further Action - Equipment Replacement

Appliances that are “Old Enough to Replace”

Refrigerator	22%
Central AC	19%
Furnace	12%
Clothes Dryer	10%
Clothes washer	7%
Window AC	6%
Dishwasher	5%



## Equipment Actually Purchased in 2001 & 2002

*3/4 of  
purchasers  
did report  
taking energy  
into account*

	<u># of units</u>	<u>% of items</u>
refrigerator	125	28
washer or dryer	106	24
electronics, misc.	45	10
range or oven	38	9
TV or computer	36	8
dish washer	29	7
water heater	25	6
microwave	20	5
air conditioner	7	2
freezer	5	1
furnace	4	1
	<hr/> 440	<hr/> 100%



## But Not a Simple Story...

84% of new refrigerator purchasers HAD NOT identified the fridge as a candidate for replacement



0 20 40 60 80 100



## In short . . .

- Unexpected flexibility
- Not weather or money
- Significant energy & demand benefits
- Persistent and serious (with change over time)
- New sensitivity to energy problems
- Willingness to participate in solutions

However, consumer response is

- Segmented
- Not automatic
- Requires appropriate bargains



# Key Factors in Conservation and Efficiency Choice

Concern - *awareness & motivation*

Capacity - *knowledge & resources*

Conditions - *circumstances & constraints*

$$EE = C_1 + C_2 + C_3$$



# Consumers are likely to be willing to take Significant Action if:

## Concern present

- The problem at hand is believed to be real and perceived to be important (system needs, environment)

## Capacity exists

- Action is imaginable and reasonable to request

## Conditions permit

- No serious constraints and costs/benefits equitable



# Implications for DR

- Peak shifting (e.g. clothes washing, dish washing, cooking, cleaning) was reported, but relatively rare
  - more likely in Hispanic and two-adult HHs
- Cooling changes were more frequent (and likely more important)
  - raising thermostat settings (the suggested behavior) was quite rare
  - non-AC use and sparing use (manual) of AC was much more common



## However . . .

- ability to respond limited, even in emergencies  
(73% knew of alerts; only 40% acted)
- knowledge & information constraints (not stupid, but have different perspectives & arrangements)
  - 92% had heard of “peak energy use problem”
  - 40% incorrectly identify peak period (or didn’t know)
- at least 1/3 never see bills



# PSU/CEC Work in Progress on Conservation & Demand Behavior

- Variation in TOU demand patterns  
(w/ weather & temporal effects)
- Social segmentation of routine action and conservation behavior
- Effectiveness of info. and delivery systems
- How new DR technologies “fit” (and don’t) into different HH contexts & cultures
- Automatic vs. manual control strategies & outcomes
- DR policy design and equity impacts



# For More Information...

- Publications from this research are available on the California Energy Commission website <http://www.energy.ca.gov>
- Loren Lutzenhiser, Principle Investigator, School of Urban Studies & Planning, Portland State University [llutz@pdx.edu](mailto:llutz@pdx.edu)
- Sylvia Bender, Contract Manager, Demand Analysis Office, California Energy Commission [sbender@energy.state.ca.us](mailto:sbender@energy.state.ca.us)